REPORT

OF THE

NEW JERSEY STATE COLLEGE

FOR THE BENEFIT OF

AGRICULTURE AND THE MECHANIC ARTS,

FOR THE YEAR 1867,

WITH THE

AGRICULTURAL LECTURES FOR 1866-67 and 1867-68,

DELIVERED BY

PROF. GEO. H. COOK.

TRENTON, N. J.:
PRINTED AT THE TRUE AMERICAN OFFICE.
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BOARD OF VISITORS.

JAMES M. MECUM.	First District.
JONATHAN INGHAM,	" "
WILLIAM HENRY HENDRICKSON,	Second District.
WILLIAM PARRY,	" "
D. KERR FREEMAN,	Third District.
JAMES BISHOP,	" "
JOHN COOK,	Fourth District.
ROBERT L. DASHIELL,	" "
CORNELIUS VAN VORST,	Fifth District.
SETH BOYDEN,	" "

REPORT OF BOARD OF VISITORS.

To the Honorable the Senate and General Assembly of the State of New Jersey:

The Board of Visitors of the New Jersey State College for the benefit of Agriculture and the Mechanic Arts, beg leave to submit their fourth annual report:

In accordance with the act of the Legislature establishing this Board, they have made two visits to the College during the year ending December 31, 1867.

The first visit was made June 14, 1867, when they were favored with the presence and counsel of Governor Ward.

The examination of the second and third classes were attended in the various departments. The Board were pleased to find the same thoroughness and accuracy which have marked previous examinations. The students were drilled by Colonel Kellogg in the presence of the Board. The armory, rooms and apparatus were inspected and deemed sufficient.

The Board visited the farm, and were greatly interested. The attention bestowed upon this branch of the school promises much. Their attention was particularly directed to the experiments to test the qualities of manures. The most apparent of these were the experiments with marl and flour of raw bone to stimulate the growth of grass and corn. The value of the results cannot be overrated.

The second visit was made December 17, 1867, when the following examinations were attended: The first class in mechanics and engineering, astronomy and geometry; the second class in chemistry, geometry, French and English literature; the third class in algebra, geometry, experiments in blowpipe analysis, and geometrical draughting.

The progress made in the different branches was very satisfactory.

The Trustees, with the approval of the Board of Visitors, have raised the standard of admission, by requiring three books of plane geometry and physical geography, in addition to former requirements.

The farm has been in successful cultivation during the year, and is becoming each year more interesting to the Board. Though much of the time of our students is, from the very necessities of the case, devoted to the study of the theory, yet sufficient opportunity is afforded in the practical results of the farm and the exercises of the laboratory to test by valuable experiments the teachings of the lecture room. The Faculty of Instruction, avoiding the too common mistake, of confounding an agricultural college with a manual labor school, are pursuing with great success the object contemplated in the liberal endowment of these State schools by the National Government, viz.: So to combine the theory and practice, that our students shall go forth fully prepared to comprehend and meet the demands of their vocation—becoming in each county the centres of new and intelligent plans and efforts for the development of the great resources of our noble State.

The enthusiasm of the students, especially in the departments of civil engineering and analytical chemistry, has given the Board great satisfaction. But few of the students in the present stage of the school are now pursuing the subject of agriculture. Some are preparing for the course on that subject.

In accordance with the provisions of the law, Dr. Cook, one of the Professors of the School, has delivered lectures on agriculture in each of the counties of the State. These lectures, practical, thorough, and comprehensive, have elicited much interest. They have evoked the spirit of inquiry and led to the formation of farmers' clubs in many places. The two lectures delivered by Dr. Cook were submitted to the Board, and are herewith transmitted, with our earnest recommendation that they be printed for general circulation in the State. Your honorable bodies could not do a greater service to your constituents, especially in the rural districts, than by furnishing them copies of these lectures.

At the next commencement of Rutgers' College, the first class in the State College having completed the course, will receive their diplomas. The Board look forward with special interest to this occasion, and cordially invite the friends of our State College to be present.

The Board, in closing this, their fourth report, desire to mention the uniform courtesy extended to them by the faculty and trustees of Rutgers' College. Every facility has been afforded for a thorough inspection of the condition and workings of the School. And they again renew the expression of their conviction that the authorities of Rutgers College are faithfully administering the trust which you have committed to them.

R. L. DASHIELL, *Secretary.*

REPORT OF TRUSTEES.

To His Excellency Marcus L. Ward, Governor of the State sf New Jersey:

SIR:—I beg leave to submit the third annual report of Rutgers' Scientific School, in accordance with the direction of the fourth paragraph of section fifth of the act of Congress, approved July 2, 1862, and section fifth of the act of the Legislature of New Jersey, approved April 4, 1864.

FACULTY OF RUTGERS' SCIENTIFIC SCHOOL.

During the year ending November 30th, the Institution has been under the instruction of the following faculty:

Rev. William Henry Campbell, D. D., LL. D., President, and Professor of Moral Philosophy.

George H. Cook, Ph. D., LL. D., Vice President, and Professor of Chemistry and Agriculture.

David Murray, A. M., Ph. D., Professor of Mathematics, Natural Philosophy and Astronomy.

Gustavus Fischer, Professor of Modern Languages and Literature.

Rev. Theodore Sanford Doolittle, A. M., Professor of Rhetoric, Logic and Mental Philosophy.

Col. Josiah Holcomb Kellogg, Maj. U. S. A., Professor of Civil Engineering and Military Superintendent.

——— Voorhees, Professor of History, Political Economy and Constitutional Law.

Francis Cuyler Van Dyck, A. B., Tutor in Chemistry.

Isaac E. Hasbrouck, A. B., Tutor in Mathematics.

John H. Knight, Superintendent of Experimental Farm.

The appointment of Dr. Cook as Professor of Agriculture, in the opinion of the Trustees, promises to be of the greatest advantage to the Institution.

COURSE OF STUDY.

The course of study pursued has been that originally adopted and reported in 1865. The Trustees have considered the propriety of increasing the requirements for admission to the lowest class in the School. And in view of the great amount of matter to be studied in the three years course, and of the growing ability of all preparatory schools to furnish a better preparation, they have resolved, if the Board of Visitors give their concurrence, to add "three books in plane geometry, and physical geography" to the subjects for examination at admission. This resolution has been transmitted to the Board of Visitors, and will be laid before them at their semi-annual meeting in December, and if it receive their sanction, the additional requirements will be demanded for admission to the class to be organized in 1868.

ADMISSION.

The terms required for admission to the full course will then be as follows:

Applicants must be at least sixteen years of age, of good moral character, and must sustain a satisfactory examination in English Grammar, Geography, Spelling, the whole of Arithmetic, Alegebra to Equations of the second degree, three books of Plane Geometry, and Physical Geography. Students applying for admission to advanced classes will be examined upon the subjects already passed over by the classes.

Students who wish to pursue partial courses of study, as Chemistry, Agriculture, Surveying, or other subjects of practical science, are admitted if they are qualified in preparatory studies.

CLASSES IN THE INSTITUTION.

The classes now in the Institution are: First—The class organized in September, 1865, and which will graduate in June 1868. Second—The class organized in September, 1866. Third—The class just organized in September, 1867.

The First class contains at the present time seven students; the Second, seventeen students, and the Third, thirteen students. Total, thirty-seven. There have been in this Institution during the year, forty-seven persons, including three special students in Chemistry. Of these, five were from the State of New York, and the remainder from the State of New Jersey. The counties being represented as follows:

Atlantic county, ...	1
Cumberland "	1

Essex county,	6
Mercer “	4
Middlesex “	16
Monmouth “	3
Passaic “	1
Somerset “	5
Sussex “	2
Union “	3

STUDIES OF THE CLASSES.

The studies of the First class since the last annual report have been as follows:

During the term beginning January, 1867, they studied Shades and Shadows, Analytical Geometry and Calculus, with Col. Kellogg. Hickok's Phsycology, with Prof. Doolittle. Attended lectures on Chemistry with Dr. Cook. Practiced blow-pipe and test-tube analysis with Mr. Van Dyck; studied French with Prof. Fischer. During the Spring term beginning April 1867, they studied Bartlett's Mechanics and Bartlett's Acoustics and Optics with Col. Kellogg, Railroad Engineering with Prof. Murray, Hickok's Phsycology with Prof. Doolittle, and French with Prof. Fischer. During the Fall term, beginning September 1867, they have attended lectures on Evidences of Christianity with the President, studied Astronomy with Prof. Murray, Bartlett's Mechanics of Fluids and Mahan's Civil Engineering with Col. Kellogg, and German with Mr. Hasbrouck.

They have also during the year been exercised regularly in composition and declamation.

The Second class during the winter term studied algebra and meteorology with Dr. Cook, geometry and geometrical draughting with Col. Kellogg, French with Prof. Fischer, and elocution with Prof. Doolittle. During the spring term they studied trigonometry and surveying, descriptive geometry and geomatrical draughting with Col. Kellogg, French with Prof. Fischer, English literature with Prof. Doolittle, and botany with Mr. Van Dyck. During the fall term they have studied analytical geometry and descriptive geometry with Col. Kellogg, surveying with Mr. Hasbrouck, chemistry and French with Mr. Van Dyck, and English literature with Prof. Doolittle.

During the year the class has been regularly exercised in composition and declamation.

The Third class entered the Institution in September, and during the term have studied algebra and geometry with Mr. Van Dyck, French with Prof. Fischer, geomatrical draughting with Mr. Hasbrouck, and elocution with Prof. Doolittle. They have been drilled also in declamation and composition.

MILITARY EXERCISES.

During the fall and spring terms of the year all the members of the Scientific School, together with volunteer members from the classes of the College, have been drilled by Col. Kellogg in the manual of arms and in company evolutions.

The arms and accoutrements furnished by the Quartermaster General of the State have been in use by this company and are now in good condition. The Trustees have furnished and fitted up an armory in which this State property is safely and properly cared for.

APPOINTMENT OF STUDENTS,

Information concerning the character and design of the Institution, its facilities for affording education and the requirements for admission, is being circulated through the State Board of Education and the Boards of Examiners in the various counties. The Trustees are anxious that the vacancies from all the counties should be filled, and are prepared to give every facility to the admission of State students.

GRADUATION OF STUDENTS.

The Trustees, in view of the approaching completion of the prescribed course by the oldest class in the Institution, have determined the character of the diplomas, and the status of the graduates, with other things connected with the graduation of the students. The graduates are to receive a diploma of *Bachelor of Science*, and those having the Institution without completing either of the prescribed courses will receive a certificate setting forth their actual attainments. each student, preparatory to graduating, shall present a written thesis connected with some subject of study. The closing exercises of the Institution shall consist of the reading of selected theses, and the delivery of an address by some person obtained for this purpose. The award of diplomas and certificates shall be made at the commencement of the College, when the other graduates of the College shall also receive their diplomas.

ROOMS AND ACCOMMODATIONS.

These remain essentially as at date of last report, except that, as the increasing wants of the School require, additional rooms and equipments are added.

UNIVERSITY STUDENTS.

In addition to the students in the Institution pursuing a complete course of study and intending to be graduated from the Institution, a number of persons are connected with it who are pursuing selected studies bearing upon some special department. These students are sometimes desirous of becoming surveyors or chemists, and have not the time or the facilities for passing through the entire line of studies. The Trustees feel disposed to grant facilities to persons for pursuing such partial courses of study, and when they are found sufficiently proficient to go on with profit in the classes, they are classified with the regular classes in the subject which they are studying.

AGRICULTURAL LECTURES.

A clause in the law establishing the State Agricultural College requires that the Board of Trustees shall cause to be delivered annually in each county of this State one or more public lectures upon the subject of agriculture, free of charge. The first of these lectures was delivered last winter and spring. It was upon Agriculture in New Jersey, its condition and advantages, and the means for its improvement. It excited considerable attention in the agricultural counties, and reports of it were printed in most of the newspapers of the State. On account of the weather many of these lectures were postponed, and it was judged expedient to try another season of the year for giving them. The second lecture has been given in the autumn of the present year. It was upon Fertilizers, and gave special prominence to those which are most abundant and accessible to our farmers. It was not designed for a miscellaneous audience, but it has received the attention of many enterprising and appreciative farmers.

In a number of the counties farmers' clubs have been organized by those attending the lectures, and the interest excited is thus in a fair way of being kept up and extended. This has been the case mostly in the agricultural counties where the select and interested audiences have been in the highest degree in sympathy with the subject, and nothing more could be desired than the interested attention with which these lectures have been received. Remarks, questions and discussions have commonly followed the lectures, and some of the meetings have been prolonged two or three hours.

Enough has been done to prove that these lectures may be made a powerful means for awakening and directing agricultural enterprise in our State. To make them most effective, larger audiences should be secured. To obtain these it may be best to accompany the lectures with experiments and illustrations, to address the eye as well as the ear of the audience, thus bringing to them what neither the ear nor the printed page can show. Such a lecture upon the chemical and philosophical principles of drainage has arrested the attention and awakened the interest of an audience in the highest degree. But we also need the active co-operation of friends of agriculture in the different counties. It is not seemly or possible for the lecturer to prepare articles for the papers, or to set in motion those appliances or influences by which a proper audience is to be called together. The collection of fresh materials for the lecture, the making of analyses, the arrangement of farm experiments and trials with the labor and time of getting from the College to each of the counties of the State, are enough to engross the whole attention and energies of the lecturer, and the work of providing a room and calling together an audience should be done by the energetic and public spirited friends of agriculture in the several counties. Without the active support of farmers of character and influence this well meant effort for agricultural improvement will fail of half its object; with such support it can be maintaihed in usefulness and popular favor.

To the numerous personal friends, and friends of agriculture, who have aided in preparing the way for the lectures already given, the Trustees desire to tender their public and hearty acknowledgments.

EXPERIMENTAL FARM.

The experimental farm connected with the Agricultural College is improving in fertility and productiveness. When purchased it was in an extremely impoverished condition. It contained one hundred acres, of which six have been taken as a site for the reservoir of the New Brunswick water works. There were only a few acres of ground upon which even very light crops of corn, wheat, and grass could be grown. Thirty acres or more were uncleared, being in stumps and sprouts, and the remainder, though cleared, was not under cultivation, and was very poor and wet. Now the land under cultivation has been enriched so that excellent crops of corn, wheat, oats, and grass have been raised this year, and moderate crops of buckwheat and potatoes. About ten acres of the uncleared land have been ploughed, and a crop of buckwheat raised on them. Five or six acres of land have been underdrained, and about fifteen acres more are now being drained.

Experiments are in progress with different fertilizers. Until quite recently no satisfactory trials of the New Jersey green sand marl had been made in the vicinity of New Brunswick, and very few outside the marl region. The use of this fertilizer upon the farm has been followed by very gratifying results. A light dressing of four tons to the acre has been tried upon our upland meadows upon a marked plot, in comparison with another plot upon which flour of raw bone at the rate of four hundred pounds to the acre was sown, and another upon which no manure was put. The increased crop of hay at the first mowing was worth more than twice the value of the marl put on it, and a fair crop was cut at the second mowing. The increase from the flour of raw bone was more than equal to the value of the bone used. The good effects of the marl are also seen in the increased crops of potatoes and corn. The experiments still in progress are various, and intended to settle more clearly not only the usefulness, but also the best method of applying the marl. There is no doubt that when properly managed, it is the cheapest phosphatic manure that can be purchased anywhere in the state.

Various super-phosphates, guano, bone-dust, street-cleanings, wool-washings, stable manure, and crude night-soil have been tried, and are still on trial. Thus far the crops raised show that crude night-soil is the cheapest nitrogenous manure that we can buy.

There has been a public trial of a self-loading wagon upon the farm, which was very interesting, and which it is believed will help the favorable introduction of a very useful labor-saving invention. Trials of a machine for making ditches for land drainage are in progress, and further trials are looked forward to with deep interest and high hopes. We anticipate that by the use of this implement a large part of the cost of under-draining may be saved.

The farm is not by any means in a state of cultivation which would entitle it to the name of a model farm, but it is improving; and we believe is to have a large and good influence on New Jersey Agriculture.

During the year we have received one hundred and thirty tons of marl from the West Jersey Marl Company without charge; also twenty tons from the Pemberton Marl Company free of charges, and one hundred tons from the Squankum Marl Company, on board vessel at Port Monmouth, free of charge there. From the Peter Cooper Glue Factory two barrels of bone-dust and twelve sacks of hair; from Messrs. Ingham and Beesley, of Cape May, two bags of cancerine; from Messrs. Yarnell and Trimble, of Philadelphia, four barrels of Rhodes' super-phosphate of lime, have been received as donations, for which we propose to make trial of their fertilizing properties and give a public report.

From Messrs. Staats, Melick & Co., of Raritan, a new and complete Raritan mower and reaper has been received as a gift. It has been tried in good standing crops, and in heavy and lodged grain, and in every case has done its work easily and perfectly. We take pleasure in making public acknowledgment of these substantial encouragements to the Agricultural College, and in expressing our satisfaction that the position and objects of the farm are appreciated.

The amount received from the State Treasury since the opening of the school down to the present date is $6,924, which has been expended exclusively for the salaries of professors in the Scientific School.

All of which is most respectfully submitted on behalf of the Trustees of Rutgers College.

WILLIAM H. CAMPBELL,
President of the Board of Trustees.

New Brunswick, Nov. 30, 1867.

APPENDIX.

NEW JERSEY STATE AGRICULTURAL COLLEGE LECTURES.

LECTURE FOR 1866–7, BY PROF. GEO. H. COOK.

The subject of my lecture is: The Condition and Advantages of Agriculture in New Jersey, and the Means for its Improvement. The law of this State, which established the Agricultural College in connection with Rutgers' Scientific School, required that at least one lecture on agriculture should be given in each county of the State every year, by a professor from the Agricultural College. It is to begin this series of lectures that I am here to-day, sent by the Trustees of the College. The design of those who framed the law undoubtedly was to benefit the farmers, by establishing the freest intercourse between them and the State Agricultural College, to awaken greater interest in the principles and practice of their art, and to keep them informed in regard to the operations of the College and the experimental farm. The way in which we are to be brought together is not prescribed, and I am at a loss to know how it is to be most effectually done. It must, however, be by public spirited citizens, acting in concert with the College authorities, to call together the inquiring and progressive farmers of the several counties. I trust the experience of this year will prepare the way for most profitable meetings in succeeding years.

Agriculture is the great interest of our country. It is not only the art which supplies us with food, but it is the art which occupies the time, talents and capital of the largest portion of our population. Of the 8,287,043 men whose occupations were put down in the report of the census of 1860, 2,423,895 were farmers, 795,697 were farm laborers, and in addition to these probably one-third of the Southern slaves were engaged in tilling the soil, altogether being more than half of all the working men of the country. To these we may also add the large number of teamsters, boatmen and railroad employees engaged in transporting farm products, and the merchants engaged in their sale. By far the larger part of our population is engaged in or dependent on our agriculture, giving to it the chief share of thought and labor.

The enormous value of our agricultural products, too, gives them the leading interest and influence in the country. The value of our crops of corn, wheat, rye, oats, barley, buckwheat, potatoes, tobacco, and hay, according to the report of the Department of Agriculture, was in

1862,	$706,887,495
1863,	955,764,322
1864,	1,504,543,690
1865,	1,047,360,167
1866,	1,563,184,130

And the value of slaughtered animals, of garden truck, of fruit, of cotton (2,000,000,000 pounds in 1859), of wool, flax, hemp, butter, cheese, and other crops must have amounted to fully as much more, or to an average of $60 for every man, woman and child in our whole land, both North and South. And the capital invested

In farm lands in 1860 was	$6,645,045,007
In implements,	246,118,141
In live stock,	1,089,329,915
	$7,980,493,063

or more than $250 for every one of our whole population.

Such numbers can be but imperfectly appreciated, but compare them with other branches of industry, manufactures for example, which in 1860 employed 1,311,246 persons, had a capital of $1,009,855,715, raw material worth $1,031,605,092, and a product of $1,885,861,676, and it will be seen that the proposition with which we started is not too strong.

New Jersey has generally had the reputation of being poor in soil and backward in agriculture. Morse, in the first edition of his geography, printed at Elizabethtown in 1789, says that it "has all the varieties of soil, from the worst to the best kinds. It has a greater proportion of barrens than any of the States, if we except North Carolina; and even than this if we include the *premature State of Franklin* (*Tennessee.*) The good land in the southern counties lies principally on the banks of the rivers and creeks. The soil on these banks is generally a stiff clay, and while in a state of nature produces various species of oak, hickory, poplar, chestnut, ash, gum, &c. The barrens produce little else but shrub oaks and white and yellow pines. There are large bodies of salt meadows along the Delaware, which afford a plentiful pasture for cattle in summer, and hay in winter; but the flies and musketoes frequent these meadows in large swarms in the months of June, July and August, and prove very troublesome, both to man and beast. In Gloucester and Cumberland counties are several large tracts of banked meadow. Their vicinity to Philadelphia renders them highly valuable. Along the sea-coast the inhabitants subsist principally by feeding cattle on the salt meadows, and by the fish of various kinds, such as rock, drum, shad, perch, &c., black-turtle, crabs and oysters, which the sea, rivers and creeks afford in great abundance. They raise Indian corn, rye, potatoes, &c., but not for exportation. Their swamps afford lumber which is easily conveyed to a good market.

"In the hilly and mountainous parts of the State, which are not too rocky for cultivation, the soil is of a stronger kind, and covered in its natural state with stately oaks, kickories, chestnuts, &c., and when cultivated produces wheat, rye, Indian corn, buckwheat, oats, barley, flax, and fruits of all kinds common to the climate. The land in this hilly country is good for grazing, and the farmers feed great numbers of cattle for New York and Philadelphia Markets; and many of them keep large dairies. The orchards in many parts of the State equal any in the United States, and their cider is said, and not without reason, to be the best in the world. Although the bulk of the inhabitants in this State are farmers, yet agriculture has not been improved to that degree which, from long experience, we might rationally expect, and which the fertility of the soil in many places seems to encouarge."

This description of our oldest geographer, abridged and variously cariacatured, has been passed from one geographer to another, and to-day the children in all parts of our country are taught that "New Jersey in the north is mountanious, and well adapted to grazing; in the middle, undulating and very fertile; and in the south level and barren." And this story has been so long and so often repeated, that strangers really believe it.

Against this slander it is pleasant to present the following tabular statement, compiled in part from the United States Census Report for 1860, and partly from the results of the State Geological Survey. A comparison of the products of the southern or northern with the middle counties will show that the barrenness is in the geographer and not in our soils.

TABLE A.

COUNTIES.	Acres in Farms—Improved.	Acres in Farms—Unimproved.	Acres in Meadow and Marsh.	Total Area in Acres.	Area in Square Miles.	Cash Value of Farms.	Value per Acre.
1. Atlantic	7,897	61,890	38,003	403,462	630.4	$686,250	$10
2. Bergen	86,703	36,457	11,910	147,622	230.7	11,834 825	96
3. Burlington	170,677	113,331	25,428	551.533	861.8	17 552,539	62
4. Camden	55,733	17,837	3,652	176 186	275.3	5,992,105	81
5. Cape May	19.528	48 420	58,824	170,171	265 9	1,462.400	22
6. Cumberland	63.276	46.708	51 078	330.080	515.7	4.295 875	39
7. Essex	33.678	16.565	4.281	79.853	124.8	5.332,075	106
8. Gloucester	85.944	36,155	9,958	162 605	254.0	7,962 445	65
9. Hudson	7.375	1,421	12,896	28,051	43.8	5 106,350	581
10. Hunterdon	203.734	45.740	......	280,006	437.5	15.824,190	63
11. Mercer	107,591	19,824	1,945	141 843	221.6	10.714,244	84
12. Middlesex	106,206	39,673	7,334	192.314	300.5	9,916,005	68
13. Monmouth	138,081	66.435	5,961	289,626	452.5	16,295 970	80
14. Morris	136,093	119,238	13,856	309,581	483.7	10 462,026	41
15. Ocean	7,746	81,121	31,155	437,267	683.2	2.318,800	20
16. Passaic	41.921	48.450	......	123.321	192.7	3 769 895	42
17. Salem	113.572	35.631	28,601	222 701	347.9	10,241,468	69
18. Somerset	152,899	21 361	......	195 654	305.7	11.922 419	68
19. Sussex	175,894	86.335	......	319,968	499.9	11,105,233	42
20. Union	56,154	10,688	446	67,098	104.8	4,770.150	70
21. Warren	143,739	85,804	......	220,128	343.9	12,685,074	55
	1 944,441	1,039,084	309,328	4,849,070	7,576.3	$180,250,338	$6 04

TABLE A.—CONTINUED.

COUNTIES.	Value of Implements.	Live Stock.	Bushels of Wheat	Bushels of Rye.	Bushels of Indian Corn.	Bushels of Oats.	Bushels of Buckwheat.
1. Atlantic	$14,709	$79 002	6,889	6,391	46,217	2,302	4,267
2 Bergen	340 845	733,476	6,530	90,669	182,127	93,732	54,650
3. Burlington	556,411	1,727 430	182 212	172,872	1.031,224	239,603	36,844
4. Camden	158,005	351 303	69,476	35 599	291.522	24,820	8 360
5. Cape May	66.750	174,903	21,308	2 411	120.445	19.989	4,013
6. Cumberland	162,230	482,665	114.348	12,083	472.747	118,405	25 117
7. Essex	148 218	519,745	11,731	26,740	153 818	54.565	16 042
8. Gloucester	289 636	663,806	69 997	42,139	425,033	19,419	13,501
9. Hudson	66,815	84,205	1 692	3,005	23,542	9 924	220
10. Hunterdon	713 850	1.602,383	241,805	120,741	1,085,711	830,653	91,835
11. Mercer	366,543	859,825	136,654	36,049	594,897	475,963	48.950
12. Middlesex	298.142	868 691	103 613	55,795	487,115	350.592	57,828
13. Monmouth	510,785	1,397,445	143,256	97.224	859 877	233,014	25,337
14. Morris	307,646	1 090,484	59,653	73,106	638,384	354,920	121,548
15. Ocean	78,748	257,085	10 001	34,893	164.548	12,519	10,220
16. Passaic	83,865	375 596	6,688	45,145	113,890	57,911	33,403
17. Salem	341,493	952,594	233 494	15,343	749.781	211,182	23,150
18. Somerset	428,124	1,091,906	131,166	98,927	748,730	741,228	41,249
19. Sussex	296 290	1,396,478	25,176	238 232	505.341	274.915	142,552
20. Union	138,556	309 958	10,631	15,010	194,580	100.576	15,799
21. Warren	378 906	1,115,719	176,898	217,123	833.897	312,900	102,501
	$5,746,567	$16,134 693	1,763 218	1,439,497	9,723,336	4,539.132	877,386

TABLE A.—CONTINUED.

COUNTIES.	Bus. of Potatoes.	Bushels of Sweet Potatoes.	Pounds of Butter.	Tons of Hay.	Orchard Products	Market Gardens.	Slaug'trd Animals
1. Atlantic	16,657	6,494	35,625	6,703	494	$4,134	$24,522
2. Bergen	229,902	....	440.488	22,269	31,632	295,540	108,795
3. Burlington	485,260	117.819	694,475	60,565	53,097	267,217	669,126
4. Camden	354,585	87,149	418,217	14.574	10,188	193,738	136,399
5. Cape May	36,528	21,700	59,670	11.165	1,837	10,595	55,649
6. Cumberland	162,941	44,548	241,079	26,947	6,172	17,222	150,603
7. Essex	78,688	167	292,933	16 885	15,104	140,669	275,656
8. Gloucester	300,847	585,756	298,500	21 220	15,522	44,500	237 623
9. Hudson	19,389	515	14.826	3,917	12,063	210,765	1,230
10. Hunterdon	92,985	480	1.010,674	31,403	60,227	2.401	291,661
11. Mercer	140.991	8,133	475,860	21,199	54,491	37,887	227,216
12. Middlesex	156,102	12.151	451,644	27.760	21,046	43,029	168,307
13. Monmouth	1,051 525	42,029	609,899	34,813	25,460	133,264	312 853
14. Morris	139,208	101	706,687	38,196	21,243	8,600	210,856
15. Ocean	61,962	6,501	111,895	10.862	1.438	5,116	103,143
16. Passaic	95 055	2	295.152	13,302	2,434	42,040	59,076
17. Salem	425 272	100,865	373,363	35.698	27,788	18,340	280,021
18. Somerset	62,065	350	832,845	31,069	26,843	3 059	240,685
19. Sussex	113,098	10	2,042,987	43 078	18,896	56,720	308.319
20. Union	54.660	12	228,285	12,258	9,323	5,545	41,703
21. Warren	93 970	50	1 079,343	24,843	14,104	1,614	216 833
	4,171,690	1,034,832	10,714,447	508,726	429.402	$1,541.995	$4,120,276

In regard also to the productiveness of our soils in comparison with those of other States, the report of the Commissioner of Agriculture for 1865, states that our average crop of corn for the preceding four years was 36¼ bushels an acre, which was the fourth in the Union; in wheat it is the seventh, in oats the ninth; and when we compare the whole number of bushels of corn, wheat, rye, oats, barley, buckwheat and potatoes raised for our whole population, with the same for the whole United States, we have 33.5 bushels for each inhabitant, against 37.2 bushels in the whole Union. This is true, though an unusually large proportion of our population are engaged in manufacturing and mechanical employments. It stands sixth in the annual value of its manufactured products, though only the sixteenth in population. Our farm products very nearly, if not quite, feed our people, and in the value of our fruit and garden products we are second only to the State of New York.

Here is a table which shows the value of farm lands per acre in New Jersey, and the States immediately around her, in 1850 and in 1860, and also the amount of increase:

	1850.	1860.	GAIN.
New Jersey,	$43 67	$60 40	$16 73
New York,	29 00	38 00	9 00
Pennsylvania,	27 33	39 00	11 67
Delaware,	19 75	31 00	11 25
Connecticut,	30 50	36 00	5 50
Rhode Island,	30 82	37 00	6 18
Massachusetts,	32 50	34 00	1 50

The following table, showing the population of the State at different times, with the ratio of increase in the State and in the United States, is suggestive of the true condition of our agriculture and industry:

POPULATION OF NEW JERSEY AT DIFFERENT PERIODS.

COUNTIES.	1737.	1745.	1785.	1790.	1800.	1810.	1820.	1830.	1840.	1850.	1860.	1865.
Bergen	4,095	3,006	......	12,601	15,956	16,603	18,178	22,412	13,223	14,725	21,618	24,636
Passaic	......	......	......	......	......	......	......	......	16,734	22 569	29,013	34,856
Hudson	......	......	......	......	......	......	......	......	9,483	21,822	62.717	87,819
Essex	7,019	6,988	......	17,785	22 269	25,984	30,793	41,911	44,621	73 950	98,877	124,441
Union	......	......	......	......	......	......	......	......	......	......	27.780	35,410
Morris	......	4,436	......	16,216	17,750	21 828	21,368	23,666	25,844	30,158	34,677	36,513
Sussex	......	......	......	19,500	22,534	25,549	32 752	20 346	21,770	22,989	23 846	23,929
Warren	......	......	......	......	......	......	......	18,627	20,366	22.358	28,433	31,523
Hunterdon	5,570	9,151	......	20,153	21,261	24.556	28,604	31,060	24,787	28,990	33.654	40,758
Mercer	......	......	......	......	......	......	......	......	21,502	27,992	37.419	41,478
Somerset	4,505	3,239	......	12,296	12,815	14,725	16.506	17,689	17,455	19.692	22 057	21.610
Middlesex	4,764	7,612	......	15,956	17,890	20.381	21,470	23,157	21,893	28.635	34 812	35,916
Monmouth	6,086	8 627	......	16,918	19,872	22 150	25,038	29,233	32,909	30,313	39,346	42,868
Ocean	......	......	......	......	......	......	......	......	......	10,032	11,176	14.262
Burlington	5,238	6,803	......	18,095	21.524	24.972	28,882	31,167	32,831	43,203	49 730	50,719
Camden	......	......	......	......	......	......	......	......	......	25,422	34 457	38,464
Gloucester	3 267	3,506	......	13,363	16,115	19,744	23,089	28,431	25,438	14,655	18 444	20.134
Atlantic	......	......	......	......	......	......	......	......	8,726	8,961	11,786	11,344
Salem	5,888	6.847	......	10,437	11,371	12,761	14,022	14 155	16,024	19,467	22 458	23,162
Cumberland	......	......	......	8,248	9,529	12,670	12,668	14,093	14,374	17.189	22,605	26,233
Cape May	1,004	1 188	......	2,571	3,066	3,632	4 265	4 936	5,324	6 433	7.130	7,625
Total	47,369	61,403	140 435	184,193	211,949	245 555	277,426	320,823	373,306	489,555	672,035	773.700
N. J. per centage	......	......	......	......	15.10	15.86	13.04	15.58	16.36	31 14	37.27	......
U. S. " "	......	......	......	......	35.02	36.45	33.13	33.49	32.67	35.87	35.58	......

But with all these signs of prosperity there is still a wide field for agricultural improvement within our borders. New Jersey has an area of 7,576 square miles, or 4,848,832 acres. Of these there are 1,944,441 acres of improved land and 1,039,084 acres of unimproved land in farms, and 1,865,307 acres entirely unused for agricultural purposes. These vacant lands are many of them quite as good as those now under cultivation, as easily cleared, as cheaply tilled, and as productive as those in the oldest settled parts of the State. I have in mind a farm of 500 acres in Camden county, which has been taken up from the "pine barrens" only a few years, which might be taken as a model for the whole State. It is all in cultivation, producing heavy crops of corn, wheat, oats, potatoes and hay. The average of corn is from 50 to 70 bushels an acre; that of wheat from 20 to 30 bushels, and one year a field of 13 acres averaged 42 bushels to the acre. And the hay averages two tons or more to the acre.

Vineland, in Cumberland county, in 1861 was only an iron-furnace tract, thought worthless for farming, and kept for its yield of wood and charcoal. It had then a population of not more than a half dozen families. Since then it has been brought into cultivation, and a population of 10,000 inhabitants has settled upon it. I have seen excellent crops of corn, clover, and other products upon that new soil; and the crops of small fruits to which it is largely devoted are most satisfactory in quantity and quality. One farmer there with a farm of 65 acres, all in a rotation of corn, truck, wheat and clover, was to me a model of a skillful husbandman. He raised first-rate crops, and I think his returns, for the labor and money spent on his farm, could not be exceeded in the whole country.

Equally successful trials of this South Jersey land are being made at Bricksburg, Manchester and Toms River; at Hammonton and Egg Harbor City; at Atsion; at Glassboro', Clayton and Newfield; and at many other places along the lines of the Raritan and Delaware Bay, the Camden and Atlantic, and the West Jersey and connecting railroads, where convenient access to market invites the settler to begin his clearing. And I see no reason why our whole Atlantic shore from Long Branch to Cape May should not be as thickly settled and as profitably cultivated as the shores of the Delaware now are. But there are still a million acres of these lands to be brought into cultivation.

There are also more than 300,000 acres of meadow in the State, which are liable to be overflowed by the tide. In the counties of Gloucester, Salem and Cumbeland there are perhaps 25,000 acres of these marshes which have been dyked to keep out the tide. This has been done at a very moderate expense, say from five to fifteen dollars an acre, and the lands reclaimed are very valuable and productive. They probably pay a larger clear profit per acre than any other farm lands in the State. With a more complete system of dyking and draining, these lands may be made to rival the reclaimed lands of Holland and Eastern England.

Then, too, we have many thousand acres of wet meadows and swamps on the Passaic, the Pequest, the Wallkill and other streams. These lands are now comparatively worthless, but when properly drained and cultivated they will become the most fertile and productive lands in the counties where they lie. Of almost inexhaustible fertility, easy of cultivation, and safe from droughts, they will come to be the most highly prized of our farm lands. Now for the lack of combined and vigorous effort for general drainage they lie comparative wastes.

But it is upon the 1,039,084 acres of unimproved lands in farms that an improved agriculture is to show its largest influence, and from which it is to reap its richest harvests. These lands are rough or wet or in bushes and pasture, and in many cases, scarcely yielding enough to pay the annual cost of fencing, they are a burden to their owners. With energy, skill and capital these can nearly all be added to our cultivated lands, and made as profitable as the best. Under-draining and tillage will bring them in, and until that is done we must constantly be reminded that we are not where we ought to be in the scale of improvement.

For the pursuit of agriculture we have here many and important *advantages*. Among these are our markets, soil, climate, fertilizers, and mixed industry.

Markets—The two great markets of our continent, New York and Philadelphia, with their population of nearly two millions, lie immediately on our borders, one on either side; in addition to these, cities and towns within the State contain at least two hundred thousand more—a population for the supply of which New Jersey can only begin to provide. The extreme south end of Cape May is only 80 miles from Philadelphia by railroad, and only 150 miles from New York by steamboat. From Trenton, on the Delaware, to Cape May, along the Atlantic shore to New York and up the Hudson to the State line, are navigable waters, and steamboats and sailing vessels are constantly plying between ports on this long line and the great cities. There are 172 miles of canal, and railroads are built to all parts of the State. Already there are 855 miles of passenger and general freight lines built, and there are now 68 miles in process of construction, and other roads are projected and soon to be made. This gives a mile of railroad to every 8 8-10 square miles in the State, and brings every inhabitant within four hours of New York or Philadelphia, and within an easy day or night's journey of both cities. The daily movements of prices can be seen and the proper time for selling, and the crop can be carried to market at night, sold fresh and for the highest cash price in the morning, and the seller can return to his home in the evening. These great markets are ever greedy for produce of good quality and fresh; take all that can be got, and call for more. Our advantages of market are just beginning to be appreciated and improved.

Soil.—The soil of New Jersey is everywhere a generous one, giving back liberal returns to skilful farmers. There is, of course, every variety—clayey, sandy, gravelly, and calcareous; some much more retentive of manures than others—but none so heavy or so light but that they are susceptible of profitable cultivation. There is a larger proportion of sandy loams and sandy soils than in any other of the Middle States, and these are the soils which are growing in favor, especially with those who cultivate garden produce and small fruits for market. It is the susceptibility to improvement which characterizes and gives excellence to our soils. There is within sight of my window a meadow of cultivated grass which has been mowed for eighty years in succession, and can always be depended on for a burden of two tons or more of hay to the acre, though it is always fed off in the fall. It has never been manured and its crops are gathered without care. From the same window I can see a farm which was cultivated without manure till it became too poor to yield crops, when it was left in common, and so remained for many years. It has since been enclosed, underdrained, manured, and cultivated so as to produce luxuriant and paying crops, and was sold as a farm at $300 an acre. Such soil as the latter awakens enterprise and rewards industry and skill, while the former only provokes to carelessness and unthrift. In capability of improvement and adaptation to the purposes of agriculture and horticulture, our soil is all that can be desired.

Fertilizers.—In fertilizers our State is peculiarly favored. Besides the resources of the farm yard, which are dependent, here as everywhere, on the skill of the farmer, we have limestone and peat in abundance. And beyond these we have inexhaustible beds of green-sand marl. This remarkable fertilizer has now been used in the places where it is found, for forty or fifty years, and has been the means of raising thousands of acres of worn out lands to the highest degree of fertility. Fields too poor to raise a spear of grass, on being dressed with this substance to the amount of four or five loads to the acre, have produced heavy crops of clover, which could then be followed by corn and wheat, and the land at once brought into productive farming and parmanent fertility. Gradually its use has been extended over a wider area, until now it is carried to the extreme southern part of the State, and is working its way farther and farther in the middle and northern counties, where its effects are quite as remarkable as in those places where it was first used. More than one hundred and fifty thousand tons of marl have been carried away from the marl region on railroads and canals this year, and the quantity is increasing year by year. Its most remarkable effects are on grass and clover, but potatoes are much improved both in quantity and quality by it, and its good effects are plainly seen in all the crops of a rotation. We have used it on the Agricultural College Farm at New Brunswick on grass, corn, and potatoes with the best effects. At the pits it costs little more than the expense of digging it, which may be from twenty-five to seventy-five cents a ton. Its price is increased with the distance to which it is transported. In New Brunswick it is worth from $2.00 to $2 25 a ton. The fertilizing power is mainly in the phosphoric acid, of which it contains from two to three per cent., combined with lime or iron, and it is in the form of a fine dust. It contains also five or six per cent. of potash, and carbonate of lime from one to twenty per cent., and very commonly one or two per cent. of gypsum or plaster. It is by far the cheapest phosphatic manure that can be offered in our markets, and the day is not far distant when it will be carried to all parts of our State, and when our farmers will appreciate the advantages we possess in the monopoly of this remarkable fertilizer. A thousand tons a year of a fertilizer like guano are made from king crabs, and sold at half the price of guano, and a beginning is just being made in preparing a fish guano from the immense shoals of fish that frequent our shores. When properly worked, these fisheries will supply all the guano needed for the whole State, and at half the cost of that from Peru.

Climate.—The climate of New Jersey is mild and healthy, a mean between the enervating heat of the South and the freezing cold of the North. The average temperature of the year is 49° in the northren part and 53° in the southern part. The winters are mild, so that ploughing can be done in nearly every month of the year in the southern counties. To us who have always lived in the State, the climate has been known as a healthy one, but strangers from more northern localities, who are settling new lands, find here an exemption or relief from pulmonary disorders, which they have never before experienced, and which renders the climate delightful to them. And this cause brings large numbers here.

Mixed Industry.—The large proportion of our population engaged in mechanical and manufacturing pursuits, furnishing as it does a large home market for our produce, is not the least of our agricultural advantages. In the table of our population, it will be seen that our numbers have increased much the most rapidly within the last twenty or thirty years—a perion coincident with the growth of our manufactures.

In 1789 Morse says "the manufactures of New Jersey have hitherto been very inconsiderable, not sufficient to supply its own consumption, if we except the articles of iron, nails, and leather." The yearly product of iron at that time was "about 1200 tons of bar iron, 1200 do. of pig, and 80 do. of nail rods, besides hollow ware," &c. In 1796 there were 200 shoemakers in Newark, and 100,000 pairs of shoes were made. In 1830 the value of articles manufactured in the State was $7,054,594. In 1830, according to Gordon, there were twelve blast furnaces, producing 1671 tons of pig iron, and 5,615 tons of castings; and 108 forges, producing 3,000 tons of bar iron. There were ten rolling and slitting mills, and 16 cupola furnaces. All these yield about $1,000,000 annually. Glass was made in one flint house, and there were 12 hollow and window glass factories, with an annual product of $500,000. There were 25 small woolen factories, producing $250,000; 51 cotton factories yielding a gross product of $1,733,721; 29 paper mills, and 2,876 tan vats.

In 1860 the products of manufacture in New Jersey were valued at $81,000,000. Our mines yielded iron ore enough to make 125,000 tons of iron, and our zinc mines yielded ore enough to make 7200 tons of zinc oxide, neither of which are included in the above estimate.

That our agricultural prosperity is largely dependent upon the development of our manufacturing, mining and mechanical interests, is a plain inference from the above figures, and it is also proved from the fact that the best markets in the State are in the vicinity of our mines and manufactories—better even than in New York and Philadelphia.

THE MEANS FOR THE FURTHER IMPROVEMENT OF OUR AGRICULTURE are various. Among these may be specified: 1. A more thorough education in our common schools. 2. By joining to the skilful practice of farming, a better understanding of the principles on which it depends. 3. By fostering internal improvements and encouraging home markets.

Until 1829 there was no public provision for common schools, and for many years after that the fund set apart for free schools was very inadequate for its purpose. The subject of free schools, however, has grown in favor with our people, and last year a law was enacted which, it is hoped, will give to every child in the State the benefits of a good common school education. The effects of the old system and training are still having their influence. In the census of 1850 there were 18,665 adults who could not read. Of these 14,248 were white and 4,417 colored, 12,787 were natives and 5,878 were foreigners. At the census of 1860 there were 23,081 adults who could not read, of whom 19,276 were white and 3,805 were colored; 12,937 of them were natives and 10,144 were foreigners. The influence of education on agriculture can hardly be over estimated. In the counties along the Delaware river, which were settled by the Friends, school houses were always built with their meeting houses, the teachers were paid by the Society, and the school was free to all. The influence of this is seen in the advanced agriculture of these counties. It is the best in the State—and I have no doubt the best in the United States.

With the increased use of machinery in agriculture, there is a growing demand for intelligent and skilled labor—a demand which will be well supplied only when all the children of the country have been thoroughly grounded in the elementary branches of education.

And now that so much capital is in land, such large investments in farm implements and machinery, and so great an annual expense for manures, the most successful prosecution of farming, calls for as thorough preparation as any other industrial pursuit, or as the profession of divinity, medicine or law. So strongly has the public mind become convinced of this that most of our older colleges have founded their Schools of Science—schools in which students may be instructed in such branches of science as find their application in agricultural and other industrial arts. It is for this object that the School of Mines has been established in New York, the Sheffield School at New Haven, the Lawrence School at Cambridge, the Polytechic School at Philadelphia, and many others. To meet the want still further, Congress in 1862 made a donation of public lands to those states which should provide colleges for the benefit of agriculture and the mechanic arts. This gift was accepted by the State of New Jersey, and as the fund was too small for the establishment of a separate institution, it was thought best to join it to one of the established colleges of the State. The appropriation was given to Rutgers' College in New Brunswick, and especially to that department in it known as Rutgers' Scientific School. The Trustees of the College accepted the grant and made preparations to carry out the plan as proposed. The State has appointed two gentlemen from each Congressional District as a Board of Visitors, who have general powers of visitation and control. The School by this law becomes the State Agricultural College. Its Faculty have, with the approval of the Board of Visitors, laid down courses of instruction which they think will best meet the want of our young men who are training for business. It takes the students when they have *thoroughly studied* the branches of learning taught in our best district schools, and instructs them in all the subjects taught in college, except the Latin and Greek, and gives much more special instruction in practical surveying, draughting, civil engineering, chemistry, natural philosophy, metalurgy, and the theory and practice of agriculture. As a course of educational study it lacks that drill in the classical languages which has been thought specially useful for the professions of law, divinity, and writing for the press, and is fuller in those physical sciences which lie at the foundation of our agricultural, mechanical, manufacturing and commercial industries.

That this course of instruction will meet the wants of a very large body of our young men, I am well assured from experience. My own education, after leaving my father's farm, was in railroad engineering for two or three years, and as student and afterwards as teacher, and then as principal of the Rensselaer Polytechnic Institute, in Troy, N. Y. That institution was established for the very purposes contemplated by Congress in their donation. It was founded by the Honorable Stepeen Van Rensselaer, of Albany, in 1824, and has been in successful operation ever since. The course of instruction there is full, practical, and thorough in all departments of physical and mathematical science. The number of students is large, although the expenses are high, and the requirements for graduation are such as to severely tax the mental vigor and industry of the most gifted; though the greater number fail to accomplish the full course, and turn aside to business without the much coveted diploma. The institution is second only to West Point in. the standard of its requirements. Its students are to be found everywhere engaged in the work for which they there prepared themselves. As civil engineers, mechanical engineers, surveyors, draughtsmen, architects, superintendents of public works; as geologists, naturalists, mining engineers, chemists, doctors and lawyers, they can be found in every State in the Union, and always men of action. From long observation of this school—and it is now twenty-eight years since I went there—I am entirely confident that the course of study which we have marked out is the one which is needed, and which will meet the approval of practical and scientific men. The plan comprises two general courses, the one of civil engineering and mechanics, and the other of chemistry and agriculture. Either of these requires three years for its completion, and students are required to be examined on all the studies of a course in order to graduate in it. But such as desire it are allowed to take selected subjects in departments where they can find full employment for their time. We are constantly having students who are devoting their whole time to the study of analytical chemistry, or surveying, or some other selected subjects. The State has now forty scholarships in the institution which are free of any tuition fees. These are divided among the counties in proportion to their representation in the General Assembly of the State. Three classes are now formed, and there are about forty students in the school. The first class will graduate next June, and all its members are looking forward to an entrance upon active business in practical life.

The number of students looking to farming as their future business is not so large as the importance of the calling demands. For this state of things several reasons my be given.

1. There is still a great misapprehension as to the amount of skill and industry needed for successful farming. There is scarcely a merchant or a mechanic to be found but thinks he can manage a farm successfully, and even when he has tried and failed, and given up, saying farming does not pay, he blames the season or the soil, and not himself. And of those who have farmed successfully, there are very many who can hardly believe their sons will plough better for understanding chemistry, or raise better varieties of grain or fruit from studying botany, or market better for having some knowledge of political economy. And truly, knowledge of these sciences is no substitute for the persevering industry and practical sense of the farmer; but if the two were joined together, the learning and the skilful practice, they greatly increase a man's influence and usefulness.

2. Another reason is that the youth sees it only as a mass of practical operations; and it is only as maturity and experience are reached

that the proper relations of principles to practice are appreciated. Like the A, B, C., the multiplication table, and the catechism, the principles of science must be first taught, and then, with reflection and experience, the relations of these principles to practice will be comprehended.

The farmer needs the same education as any other citizen. It is contrary to the genius of our institutions and the spirit of our people to train young men for a special business before they have acquired the elements of general knowledge. Every citizen is entitled to vote, to judge of the acts of those in authority, to take part in public business, and may be called upon to lead in the places of legislative, judicial or executive authority. Especially is this the case in a country like ours, where agriculture is the leading business and occupies the attention of so many men of thought, men of action, and men of influence. Your sons should be trained in those branches of learning which fit them for any department of active usefulness, which stores their minds with knowledge, habituates them to speak, to write, and to act, and teaches them to know their own abilities as compared with those of their fellows.

And yet it is certain that in these institutions something in the way of positive instructions in farming is demanded, and we propose to meet it as fast as the demand can be put in definite shape. It is our present purpose to institute courses of daily lectures through a portion of the year, say from January 1st to April 1st, upon various branches of experimental science, and upon agriculture and mechanics. These lectures should include a daily lecture upon chemistry, with experiments; one daily upon natural philosophy with experiments; a course of lectures upon veterinary science—the horse, his diseases, and their treatment. Also short courses of lectures upon draining, farm implements, fertilizers—their action and mode of use—fruit culture, rural embelishment, farm accounts, with profit and loss, with other lectures from men eminent in any special department of agricultual science or practice, as occasion may require, and illustrate or verify these lectures as far as possible by experiments or observations upon the College Farm.

Three or four of these lectures should be given every day, so as to employ the time of those attending. Young men expecting to be farmers, those who have already commenced their business, and any who may desire to pursue their studies farther are the persons who would be likely to attend this course. For admittance to the lectures no previous examination should be required, and should any from age or diffidence desire not to be examined, they should be excused. Such courses of lectures could not but be profitable. They would bring together the inquiring and the enthusiastic young farmers of the State in circumstances to arouse and quicken into activity all the energies of their nature. With the facts acquired and the suggestions received in this way, the farmers would go home to their season's work with increased love for their noble employment, and strong determination to excel in it.

A plan of this sort is capable of being varied to meet the wants of the community and must finally succeed. With sure means for the education of our farmers, their chosen pursuit will become in their own estimation, as well as in that of the whole community, what Washington pronounced it—"The most healthful, the most useful and the most noble employment of man."

The fostering care of our legislators can do much to advance the interests of agriculture. The increase of taxable property which new developments or improvements bring, the enhanced value of lands and improvements already in use, and the real advantage to health, comfort and usefulness, justify the public assistance and direction in works of drainage, of internal communication and in developing natural sources of mechanical power.

So important has the work of drainage become in England, that the Government has absolutely loaned to land owners several million dollars to carry out works which were beyond their individual resources, and the result is eminently satisfactory to the public. A reference to the table of areas will show how large a surface we have which needs such improvement; it is in the hands of many owners who can have no comprehensive and matured plan for the improvement of complete tracts, and who, in many cases, cannot advance the cost of improvements, though their lands might be increased in value five or ten fold. The Drowned Lands in Sussex, the Great Meadows in Warren, and the Whippany, Troy and Passaic Meadows in Morris and Essex counties, are of this sort.

I cannot close this lecture upon what the late Bishop Doane styled "the goodly heritage of Jerseymen," without urging upon you the importance of using every proper means for improving in your useful art. I would not over-estimate the importance of these lectures. The great means of diffusing information is by the press; and upon agricultural papers you depend mainly for your knowledge of the great questions of agriculture. But there are circumstances in which the voice has important advantages, and there are local interests which the general topics of the papers hardly reach. Now if these lectures can be made the occasion for calling together our most enterprising farmers, and if after the lecture a discussion can be got up among those present, I am sure the meeting will not be without profit. Especially will this be the case if a farmers' club can be organized to hold regular meetings to discuss selected topics, to ask information on subjects of interest, to give details of work done, and generally to do each other good. There is no farmer so well informed or so skillful, but that he may learn something from his neighbor, and our country is so large and our markets so great that we need not fear any damage from the competition, or from the largest success of our neighbors.

The interest, the activity, the emulation which is excited by this meeting in friendly intercourse is salutary, and I cannot but hope you will experience its benefits.

NEW JERSEY STATE AGRICULTURAL COLLEGE LECTURES.

LECTURE FOR 1867–8, BY PROF. GEO. H. COOK.

The lecture of to-day is the second in the series required to be given in each county of the State, by "a Professor from the State Agricultural College." After visiting every county in the State I am happy to say that the favorable views formerly expressed respecting New Jersey agriculture have been fully confirmed. The progress of improved farming is rapid; waste fields and wet grounds are being reclaimed by draining and manuring; new lands are being cleared up; farms which have been opened in uncleared land, within the year are numbered by hundreds, and the business of farming is every where rising in the estimation of men of industry and forethought. When young men of education, when those who may reasonably aspire to the highest positions in life choose the pursuits of industrial art, then we may consider those pursuits to hold their proper place in public esteem, and this I am happy to say is the case in many places I have visited.

Among the topics of interest to which I might call your attention, there are two which it has seemed to me are the great ones of the day. One is drainage and the other fertilizers. I hardly know which should be taken up first. We have so much land that is wet and only to be made tillable by drainage that it seems as if this was the largest field for improvement in the State. The subject has assumed larger proportions in my estimation from a recent visit to Salem and the banked meadows of that county. There the marshes along the Delaware and its tributaries have been enclosed by banks to shut out the tide, and have then been drained and brought into cultivation. Most of them are in cultivated grass which is raised for seed, but large areas are also kept under the plow. They produce excellent crops of corn, wheat, clover, potatoes, &c., larger upon the whole than on the upland, and they are not subject to drought, and need no manuring except occasionally a little lime. The crops of grass seed are very profitable. These reclaimed marshes which have cost from $5 to $15 an acre, and are kept secure by an annual expenditure of $1 or $2 an acre, pay the interest on $200, $300, even $400 an acre. They are the most profitable lands in the State, and yet only about 25,000 acres have been brought in, while there are nearly 300,000 acres of them which are still to be drained.

Manures are the means by which the farmer is enabled to increase his crops, and there is no successful farming without them. On land which has been long cultivated the farmer is compelled to make some provision for renovating the soil, and he who makes the most liberal investments in fertilizers, will not only reap the largest crops, but also the largest profits. Instances without number can be referred to in which by the old method of taking everything off the soil and putting nothing on, a family was reduced to poverty, when a change in plan, a liberal outlay for manures has soon brought back thrift, comfort and finally wealth. Everywhere this fact can find verification; and in those places where the highest prices are paid for manures, there agriculture is most advanced, and skillful management is reaping its richest rewards.

In any system of husbandry then, the knowledge of fertilizers—their nature, their arrangement, their uses, and their values, are questions of the higest interest.

The manure which constitutes the great resource of farmers is that which is collected in stables and barnyards, and is made from the droppings of animals mixed with straw, hay, or other vegetable substance. The amount of this manure which can be produced on a farm is to a great extent the measure of its productivenes, and the care and skill with which all the manure the farm can produce is economised, is an indication of the profits of the farmer. In the article on manures in Morton's Cyclopedia, a statement is given to show the amount of manure usually made on a farm without auxiliary feeding. In the four course, or Norfolk system, which is wheat, turnips, barley, clover and ryegrass, 3 16-100 tons of manure are made for every acre in the farm. In the five course, or Northumberland, which is grass mown, grass pastured, wheat, turnips and barley, the produce of manure per acre is 2 5-10 tons; and in the six course, or East Lothian system, which is wheat, turnips, barley, grass, oats, potatoes and beans, the annual yield of manure is 3 64-100 tons for every acre of the farm. On many farms this quantity is increased by purchasing linseed cake for feed, and so almost or quite doubling the number of cattle that can be kept. I have no certain data in regard to the amount of manure made on farms in this country, but think it cannot be equal to the example cited. The value of stable manure can hardly be estimated, it sells at various prices, according to the demand, from two to four dollars a ton; I have seen some thriving farmers who were paying $3 a ton for stable manure, and then hauling it seven or eight miles. And some loads which were sold for six dollars and hauled nearly as far, though I suppose the loads were nearer two tons than one.

This manure always gives satisfaction to those who use it, and if it could be had in sufficient quanity there would be no occasion for other fertilizers. But this is not the case even in the most ordinary farming, and in high farming there is always need for much more. Wherever a supply of peat or muck can be got, the quantity of manure may be greatly increased by its use. The accompanying analysis of stable manure, and of peat, are taken from Johnson's Essay on Manures. They are average specimens. The elements of ammonia, one of the most valuable constituents of any fertilizer, are found in larger quantity in the peat than in the stable manure. The difference is that one is already to decay and give up its elements to the growing plant which is to be nourished by it, while the other, (the peat) is, in its natural state, not undergoing any change at all, and of course not supplying anything that can help the growth of vegetation. To bring the peat into a state of decay, to destroy the organic acids in it, and to cause it to give up its elements for the nutriment of other plants, several methods may be adopted.

No. (1) is the complete analysis of air-dried peat. No. (2) of well rotted stable manure.

		(1)	(2)
Water expelled at 212°,		18.050	75.420
Organic Matter.	Soluble in dilute solution of carbonate of soda.—Soluble geine,	27.190	16.530
	Insoluble in solution of carbonate of soda,	48.840	
Potash,		.041	.491
Soda,		.035	.080
Lime,		2.431	1.990
Magnesia,		.364	.138
Oxide of iron and alumina,		.310	.673
Phosphoric acid,		.030	.450
Sulphuric acid,		.331	.121
Chlorine,		.009	.018
Soluble Silica,		.494	1.678
Carbonic acid,		1.175	1.401
Sand and charcoal,		.700	1.010
		100,000	100,000
Potential ammonia,		2.920	.735
Matters soluble in water,		1.800	5.180

Johnson, in his Essay on Manures, p. 87, says "composting muck or peat appears to be the best means of taking full advantage of all the good qualities of muck, and of obviating or neutralizing the ill results that might follow the use of some raw mucks, either from a peculiarity in their compostion, (soluble organic compounds of iron; sulphate of protoxide of iron), or from too great indestructibility.

The chemical changes (oxidation of iron and organic acids) which prepare the inert or even hurtful ingredients of peat to minister to the support of vegetation, take place most rapidly in presence of an alkaline body.

The alkali may be ammonia coming from the decomposition of animal matters, or lime, potash, or soda.

A great variety of matters may of course be employed for making or mixing with muck composts, but there are only a few which allow of extensive and economical use, and our notice will be confined to these.

First of all, the composting of muck with stable manure deserves attention. Its advantages may be summed up in two statements:

First—It is an easy and perfect method of composting all manures, even those kinds most liable to lose by fermentation, as horse dung; and

Second—It develops the inert fertilizing qualities of the muck itself.

Without attempting any explanation of the changes undergone by a muck and manure compost, further than to say that the fermentation which begins in the manure extends to and involves the muck, reducing the whole to nearly, if not exactly, the condition of well rotted dung, and that in this process the muck effectually prevents the loss of ammonia.

PREPARATION OF COMPOSTS.

To a given quantity of stable manure, two or three times as much weathered or seasoned muck by bulk may be used. The manure may either be removed from the stables, and daily mixed with the appropriate amount of muck, by shovelling the two together, at the heap, out of doors; or as some excellent farmers prefer, a trench, watertight, four inches deep and twenty inches wide, is constructed in the stable floor, immediately behind the cattle, and every morning a bushel basketful of muck is put behind each animal. In this way the urine is perfectly absorbed by the muck, while the warmth of the freshly voided excrement so facilitates the fermentative process, that according to Mr. F. Holbrook, of Brattlebro', Vt., who I believe first employed and described this method, much more muck can thus be well prepared for use in the spring, than by any of the ordinary modes of composting. When the dung and muck are removed from the stable they should be well intermixed, and as fast as the compost is prepared it should be put into a compact heap, and covered with a layer of muck several inches thick. It will then hardly require any shelter if used in the spring.

On the farm of Mr. Pond, of Milford, Conn , I have seen a large pile of this compost, and have witnessed its effect as applied by that gentleman to a field of sixteen acres of fine gravelly or coarse sandy soil, which, from having a light color and excessive porosity, had become dark, unctuous and retentive of moisture, so that during the drouth of 1856 the crops on this field were good and continued to flourish, while on the contiguous land they were dried up and nearly ruined.

By reference to the transactions of the Connecticut State Agricultural Society for 1857, it will be seen in the very interesting report of the Committee on Farms and Reclaimed Lands, that on the farms which received the high premiums, and the most honorable mention, composts of muck and stable manure are largely employed. In the opinion of many excellent farmers a well made compost of two loads of muck and one of stable manure is equal to three loads of the manure itself.

In the vicinity of cities, muck is often composted to great advantage with night soil. Every farmer who can, would find it profitable, and not only so, but pleasant and healthful, to compost the privy and sink waste of his premises with muck. The outlay of a few dollars would provide such conveniences as are needful to accomplish this with ease and instead of being afflicted with a nuisance, yielding an intolerable quantity of miasmatic smell and a few shovelfuls of effete waste, he might convert his necessary into an odorless convenience, and make enough poudrette to fertilize a large garden to the highest degree.

Guano, so serviceable in its first application to light soils, may be composted with muck to the greatest advantage. Guano is an excellent material for bringing muck into good condition, and on the other hand muck prevents any waste of the costly guano, and at the same time, by furnishing the soil with its own ingredients, to a greater or less degree prevents the exhaustion that often follows the use of guano alone. The quantity of muck should be pretty large compared to that of the guano—a bushel of guano will compost six, eight, or probably ten of muck. Both should be quite fine, and should be well mixed, the mixture should be moistened and kept covered with a layer of muck of several inches of thickness. This sort of compost would probably be sufficiently fermented in a week or two of warm weather, and should be made and kept under cover.

If no more than five or six parts of muck to one of guano are employed, the compost, according to the experience of Simon Brown, Esq., of the *Boston Cultivator*, (Patent Office Report for 1856.) will prove injurious if placed in the hill in contact with seed, but may be applied broadcast without danger.

The moss-bonkers, so abundantly caught along our coast, and in our sounds during the summer months, or any variety of fish may be composted with muck, so as to make a powerful manure, with complete avoidance of the excessively disagreeable stench which is produced when these fish are put directly on the land. A layer of muck one foot or more in thickness is spread upon the ground, and covered with a layer of fish; on this is put another layer of muck and another of fish, and so on till the pile is several feet high, finishing with a good layer of muck.

In the summer when this work is usually attended to, the fermentation begins at once, so that no delay must be allowed after the fish are taken, in mixing the compost, and in a short time the operation is complete; the fish disappear, bones excepted, and by shovelling over, a uniform mass is obtained, almost free from odor, and retaining perfectly all the manurial value of the fish. Lands well manured with this compost will keep in heart and improve, while, as is well known to our coast farmers, the use of fish alone is ruinous in the end on light soil.

It is obvious that any other easily decomposing animal matters, as slaughter-house offal, soap-boiler's scraps, glue waste, etc., etc., may be composted in a similar manner, and that all these substances may be made together into one compost.

In case of the composts with guano, yard manure and other animal matters, ammonia is the alkali which promotes these changes, and it would appear that this substance, on some accounts, excels all others in its efficacy, but the other alkaline bodies, *potash* and *lime*, are scarcely less active in this respect, and being at the same time, of themselves useful fertilizers, they may be employed with double advantage in preparing muck composts.

Potash lye and *soda-ash* have been recommended for composting with muck; but although they are no doubt highly efficacious, they are quite too costly for extended use.

The other alkaline materials that may be cheaply employed and are recommended, are *wood ashes*, leached and unleached; *ashes of peat*, *marl*, (consisting of carbonate of lime), *quicklime*, *gaslime*, and what is called "*salt and lime mixture.*"

With regard to the proportions to be used, no definite rules can be laid down; but we may safely follow those who have had experience in the matter. Thus, to a cord of muck, which is about 100 bushels, may be added of unleached wood ashes twelve bushels, or of leached wood ashes twenty bushels, or of peat ashes twenty bushels, or of marl or gas lime twenty bushels.

Ten bushels of quick lime, slaked with water or salt brine previous to use, is enough for a cord of muck.

Instead of using the above mentioned substances singly, any or all of them may be employed together.

The muck should be as fine and free from lumps as possible, and must be intimately mixed with the other ingredients by shoveling over. The mass is then thrown up into a compact heap which may be four feet high. When the heap is formed, it is well to pour on as much water as the mass will absorb, (this may be omitted if the muck is already quite moist), and finally the whole is covered over with a few inches of pure muck, so as to retain moisture and heat. If the heap is put up in the Spring, it may stand undisturbed for one or two months, when it is well to shovel it over and add water if it has become dry. It should then be built up again, covered with fresh muck, and allowed to stand as before until thoroughly decomposed. The time required for this purpose varies with the kind of muck, and the quality of the other material used. The weather and thoroughness of intermixture of the ingredients also materially affect the rapidity of decomposition. In all cases five or six months of summer weather is a sufficient time to fit these composts for application to the soil.

The use of "*salt and lime mixture*" is strongly recommended by so many writers, that a few more words may be devoted to its consideration.

In Dr. Dana's Muck Manual, and in Johnston's Agriculturl Chemistry, it is stated that common salt is decomposed by quick lime with the production of carbonate of soda. Now although this change *may* occur in the soil or in presence of the organic matters of peat, yet there is no proof that it does take place, and all the probabilities are opposed to such a change, so that from theoretical grounds, there is no advantage to be anticipated from a mixture of salt and lime over the unmixed lime, as far as the action on peat or muck is concerned.

But the extraordinary usefulness of the salt and lime mixture for composting has been so extensively and vigorously maintained, that many will be inclined to despise the chemistry that doubts its benefits.

Therefore, without entering into a chemical discussion of its merits, we will be content here, to assert that, if useful, its usefulness is not as yet explained, or the explanations given are entirely unsatisfactory.

That it is useful is testified to by good farmers, as follows: Says Mr. F. Holbrook, of Vermont, (quoted from Patent Office Report for 1856, page 193,) "I had a heap of seventy-five half cords of muck, mixed with lime in the proportion of a half cord of muck to a bushel of lime. The muck was drawn to the field when wanted in August. A bushel of salt to six bushels of lime was dissolved in water enough to slake the lime down to a fine dry powder, the lime being slaked no faster than wanted, and spread immediately while warm, over the layers of muck, which were about six inches thick; then a coating of lime and so on, until the heap reached the height of five feet, a convenient width, and length enough to embrace the whole quantity of muck. In about three weeks a powerful decomposition was apparent, and the heap was nicely overhauled, nothing more being done to it till it was loaded the next spring for spreading. The compost was spread on the plowed surface of a dry sandy loam at the rate of about fifteen cords to the acre, and harrowed in. The land was planted with corn, and the crop was more than sixty bushels to the acre."

Other writers assert that they "have decomposed with this mixture spent tan, sawdust, cornstalks, swamp muck, leaves from the woods; indeed, every variety of inert substance, and *in much shorter time than it could be done by any other means.*"

The poudrette of the Lodi Manufacturing Company was made by mixing night soil from New York City with peat from the marshes on the Hackensack river. The handling, drying, sifting and mixing of the night soil is all attended with expense, which is afterwards heavily increased by the cost of packages and transportation, but with all these disadvantages it still maintains the character which Mr. Downing gave it in the *Horticulturist* years ago.

"For all the neater work of sowing and planting in gardens, we prefer it to any other manure. For strawberries, for early vegetables, flower beds, roses, &c., it is preferable to everything usually to be had; because, unlike guano, it enriches without burning, may be used safely with any plant, and brings no weeds like common manure. We consider a barrel of it fully equal, in fertilizing material, to four cart loads of stable manure; while being pulverized, it is much more readily managed in mixing it with light garden soil. For farm crops it is equally valuable whenever the farmer can afford to pay for manure at the rate of seventy-five cents a wagon load, and a barrel may, in using it, be considered equal to two such loads. It should be used in the hill for corn and potatoes, and in the drill for beets and carrots."

Composts made according to one or other of the above directions, have long been in use, and they are now very largely used by the new settlers in the southern part of the State, and the testimony is all in their favor. Still there is room for a great increase in their use; the chemical analysis shows a cause for their good effects; experience shows that the products of manure on a farm can be trebled by them. In any system of improved farming the making of compost must necessarily occupy a prominent place.

Of the manures containing ammonia, which must be purchased, Peruvian guano stands first on the list, after night soil. Applied in quantities of from 100 to 400 pounds per acre, it acts powerfully, producing large crops, and seeming to almost exhaust itself in a single year. Its present price is about $90 a ton, and there are many farmers and gardeners who think it the cheapest of manures at that price. For a crop of wheat, grass, turnips or cabbage, it generally increases the single crop to an extent far beyond the cost of the fertilizer. The following is an analysis of a carefully averaged sample of guano.

ANALYSIS.

Water,	13.914
Sand,	1.962
Lime,	10.264
Potash and Soda,	5.874
Phosphoric acid,	10.155
Organic matter and salts not estimated,	57.831
	100.000
Ammonia in 100 parts,	14.793

When guano was $55 a ton, ammonia was estimated at 14 cents a pound. At that rate, and it certainly is not too high, ammonia should now be worth 20 cents a pound.

There are two sources within the State for concentrated manures containing ammonia, which can be made available in many places with a considerable saving in expense. One is cancerine, a manure made by drying the common kingcrab or horsefoot, and grinding it in a mill; and the other is fish guano, which is made from the common moss-bonker or menhaden by steaming the fish, pressing out the oil, and then drying and grinding the residuum. The following are analyses of these substances—(1) is the cancerine, (2) the fish guano:

ANALYSES.

	(1)	(2)
Water,	9.321	
Organic matter and loss,	70.867	78.301
Lime,	4.358	8.670
Phosporic acid,	2.714	7.784
Sulphuric acid,	5.170	
Silicic acid,	3.883	1.333
Potash,	3.687	1.545
Soda,		1.019
Magnesia,		0.670
Chlorine,		0.678

The cancerine is made in Cape May, and is readily sold to farmers at $25 a ton. It is used on wheat and to some extent on other crops, and all the experience in regard to it, is that, two tons of it are as good as, if not a little better than, one ton of guano. The quantity made is limited by the annual supply of crabs to about 1,000 tons. For wheat raising it is a much cheaper fertilizer than guano, costing only 5-9 as much. The analysis, however, shows a deficiency of lime and phosphoric acid, and it is everywhere observed that clover does not thrive after it, while timothy grows most luxuriantly. Composting it with some of the super-phosphates would undoubtedly increase the fertilizing power of both substances.

The fish guano has been made to a small amount on Raritan bay, and a company has been organized for its manufacture in Atlantic county. The supply of material is almost unlimited, and it only needs capital and skill to build up a business of great importance to the State and profit to the manufacturer. On the coast of Long Island, and of Maine, where the business has been carried on for the oil which could be got from the fish, the residuum has been sold at various prices from $15 to $30 a ton, and has been a very popular fertilizer with those who have used it. It is sought for by the manufacturers of super-phosphate of lime, to mix with their product, and there can be no doubt that it would be very beneficial in such a mixture, giving quickness to its action while the super-phosphate would add to the duration of efficiency. When this source of manure is properly worked, it can be made to supply all the guano needed in the State.

A moderate supply of ammoniacal manure can be got along our sea-shore from the mussels which abound in some parts of the bays and sounds. Near Forked River, in Ocean county, some remarkable effects of the use of mussels upon the growth of young peach trees were observed. They had been applied directly from the water; furrows were plowed along on each side of the nursery rows of little trees, and then the mussels were dropped in and covered. The trees were about 2½ feet high, and as luxuriant as weeds, while those not thus treated were only about half as high, thin and yellow. Mussels are used with various crops, and are applied by depositing them where they are to be covered in, and then letting them lie till putrefaction begins, when they are covered up with earth. It is the common impression that both mussels and raw fish are much more efficient if left in the open air till putrefaction begins, than if covered up in earth as soon as taken.

A lot of the mussels sent by Mr. David Tichenor, from Forked River, were examined. Four pounds two ounces were dried over a stove, and lost two pounds three ounces in weight. Four ounces of this dried substance was then burnt, and lost three quarters of an ounce. This would show that the mussels were:

Water,	53. per cent.
Organic matter,	9. " "
Shells and earthy matter,	38. " "

An analysis of the dry shells and organic matter showed them to contain 1 .52 per cent. of the elements of ammonia, which is equivalent to 81-100 of one per cent. of ammonia in the raw mussels. An analysis of the burnt shells gave the following results:

ANALYSIS.

Sand,	25.4
Lime,	36.0
Carbonic acid,	22.2
Magnesia,	0.5
Alumina,	0.1
Oxide of iron,	2.0
Salt,	2.8
Organic matter,	10.5
	99.5

Large masses of worms with calcareous shells are found in some of the bays in sufficient quantity to make them valuable for manure, and they are used for that purpose wherever they can be got. They are like the mussels, very quick in their action, but as the calcareous matter which incrusts them crumbles much easier than the mussel shells they are preferred as a permanent fertilizer. Three pounds seven ounces of them sent by Mr. Tichenor, dried away one pound two ounces.

The analysis of the worms is:

Water,	33	per cent.
Organic matter,	16	"
Calcareous matter (ash),	51	"
	100	"

The dried matter analyzed gave of the elements of ammonia 55-100 of one per cent., which in the fresh substance would be 37-100 of one per cent. The following is an analysis of the ashes obtained by burning the dried matter:

Sand,	6.33	per cent.
Lime,	43.86	"
Carbonic acid,	29.20	"
Magnesia,	5.22	"
Oxide of iron and alumina,	4.47	"
Salt,	2.69	"
Organic matter,	8.00	"
	99.77	"

There are great quantities of sea-weed found in some places along the shore, or growing in the shallow water. An examination was made of specimens of the variety which is locally known as *salad*. Twenty-eight ounces of it when thoroughly dried in the sun weighed only 5¼ ounces—that is, it lost 81 per cent. of water. The dried weeds when burned left 76 per cent of ash, which is equivalent to nearly 15 per cent. in the fresh weeds. There were found in the dried plants 1 45-100 per cent. of the elements of ammonia, which shows a per centage of 21-100 of ammonia in the freshly-gathered *salad*. The analysis of the ash is as follows:

Sand,	71.4
Oxide of iron and alumina,	14.8
Lime,	4.9
Magnesia,	4.8
Salt,	1.4
Sulphuric acid,	2.4
	99.7

Sea-weeds like the above are extensively used wherever they can be obtained, and the analysis confirms the results of experience as to their good effects on the land. Their exclusive use tends to increase the groowth of sorrel, and fields that are manured with them should receive a dressing of quick lime on the years when the sea-weed is not applied.

The annexed table, which is from "Boussingault's Rural Economy," is presented to show the amount of mineral matter of different kinds that is taken from an acre of ground in a year by various cultivated crops.

CROP.	Dry Crop.	Ashes per cent.	Quantity of Ashes per acre.	Phosphoric.	Sulphuric.	Chlorine.	Lime.	Magnesia.	Potash and Soda.	Silica.	Oxide of Iron, Alumina, &c.
	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs	lbs.
Potatoes	2,828	4.0	113	13	8	3	2	6	58	6	17
Beet Roots	2,908	6.3	183	11	3	9	13	8	82	15	4¾
Half crop of Turnips consumed off ground.	656	7.6 6.0	50 303	3 33	5 7	1¼ 4	5 7	2 5	19 135	3 39	0.7 16
Potato Tops	5,042	6.0	303	33	0.3	4	0.8	4	135	39	16
Wheat	1,052	2.4	25	12	0.3	....	0.8	4	7	0.4	.....
Wheat Straw	2,558	7	179	5	1.5	1	15	9	17	121	1¾
Oats	975	4	39	6	0.4	0.2	12	3	5	21	0.6
Oat Straw	1,176	5.1	60	1½	2.5	3	5	15	17	24	1
Clover	3,693	7.7	284	18	7	7	70	18	77	15	0.9
Manured Peas	915	3.1	28	8	1.2	0.3	3	3	10	0.5	Traces

These are the constituents of plants which must come from the soil, the ammonia and carbonic acid which are found in the air, and may gradually be brought down and made to nourish the growing plant, but these mineral substances must be in the soil, and if not naturally there in sufficient quantity they must be put there by the farmer. All of these are equally important to the life of the plant, but some are much more abundant and cheap than others. Thus there is scarcely a soil in which there is not enough silica and oxide of iron to be found. Lime and magnesia can be supplied at very cheap rates. Among all, that which is found in smallest quantity, in soils and of course is soonest exhausted is phosphoric acid. And as it is scarce everywhere, it is rated at a high price. Super-phosphate of lime sells for $50 or $60 a ton, and pays the farmer well at that price; if we judge from this of the value of phosphoric acid, the soluble variety must be worth from 20 to 25 cents a pound—while the insoluble variety, such as is found in bones is not worth more than 5 or 6 cents a pound. It becomes then an interesting, if not an easy problem, to determine the impoverishing effects of different crops, and to so arrange them in rotation as not to exhaust the soil of any one of its constituents while there is an abundance of others still left in the soil.

Phosphoric acid is removed from the soil in all seeds and grain and also in milk and cheese, and in the flesh and bones of animals. It can be returned to the soil in crushed and ground bones, and in the various preparations of super-phosphate or soluable phosphate of lime. Raw bones are exceedingly insoluble, so much so that it is not uncommon to find bones a little below the surface which must have lain there hundreds and in some cases thousands of years. On or near the surface it undoubtedly takes from 10 to 50 years for their decay. By crushing them into small fragments they decay much sooner, and if they can be ground to flour or turned into fine dust and shavings as in the button factories, they decay or dissolve with sufficient rapidity to make a quick and valuable fertilizer even when used in quantities of from 200 to 500 pounds to the acre. The following is an analysis of dry ox bones by Berzelius;

Phosphate of lime,	57.35
Bone gelatine,	33.30
Carbonate of lime,	3.85
Phosphate of magnesia,	2.05
Soda and a little salt,	3.45
	100.00

There is about 30 per cent. of phosphoric acid in this specimen, but as bones are ordinarily ground for manure, they contain water and grease; and more or less dirt is allowed to get mixed in with them. The fertilizing action of ground bones is due partly to the animal matter in them, and not entirely to the phosphate of lime, for the mineral phosphates of lime which contain from 40 to 45 per cent. of phosphoric acid, have no value as fertilizers, even when ground fine. It is not posible, however, to grind the mineral phosphates as fine as bones become in crumbling away or losing their animal matter. We have tried the flour of raw bone of the Boston Milling Company at the rate of 400 pounds to the acre, on our grass fields, with excellent effect. The increase of the single crop of hay this year, was enough to pay for the bone dust.

At the glue factories bones are boiled under pressure so as to extract most of the animal matter from them. They can then be dried and ground very fine, and with the little animal matter still left in them, they make an excellent fertilizer. That from the Peter Cooper Glue Factory, in New York, has been tried on farms about New Brunswick with excellent results. We have some on trial on the College Farm. Two varieties are sold, one white, clean, and very fine, and the other yellower, and not so finely ground. No. (1) is the white, and No. (2) the yellow:

	(1)	(2)
Phosphoric acid,	28.8	29.6
Lime,	38.1	37.8
Magnesia,	1.2	1.6
Insoluable matter,	.6	1.1
Organic matter and water,	30.9	28.6
	99.6	98.7
Elements of ammonia,	2.3	2.1

At $50 a ton for No. (1) and $40 for No. (2) this bone dust finds a ready sale, and the same persons are using it year after year and are satisfied that to them it is worth all it costs.

On account of the insolubility of bones even when ground as fine as the best mill can grind them, it has been found economical to treat them with sulphuric acid, and in that way to make them soluble in water, and so quicken their action, and render them capable of being profitably used in smaller quantities. Ground bones treated with sulphuric acid, and dried so as to fit them for handling and sale, formerly constituted super-phosphate of lime, and some of that now sold is made from bones. But the large quantity now used in our country, which is said to be 60,000 tons a year, is more than all the bones sent to market can supply, and much super-phosphate is made from rock or phosphatic guanos. These super-phosphates have answered their purpose as fertilizers admirably. Their use is increasing every year, and must continue to do so wherever an improved agriculture is practiced. There are a large number of manufacturers of this fertilizer, whose products are found in our markets. Some manufacture from raw bones, some from burnt bones, some from bone black, some from rock guanos, and others from mineral phosphates, so that they differ greatly from each other in appearance, and the eye cannot distinguish a good article from a poor one. This has led unscrupulous manufacturers or dealers to adulterate these manures with worthless ingredients, and in some cases to sell an article which was entirely spurious for the genuine. But as the business gets more in the hands of men who have invested large sums in the manufacture, and have a reputation to maintain, it is less liable to abuse. And a much more uniform article is now sold than that which was in the market a few years ago. Then that which was made of pure materials had from 12 to 15 per cent, of soluble phosphoric acid, and a great deal was offered which, for some reason did not contain more than from 1 to 4 per cent of that acid.

I present here analyses of three super-phosphates of lime:

	(1.)	(2.)	(3.)
Soluble phosphoric acid,	7.01	6.72	7.00
Insoluble " "	12.96	17.48	6.12
Lime,	25.08	31.17	22.42
Magnesia,	.86		1.21
Alumina,	13.02	1.59	.80
Sulphuric acid,	14.47	17.80	9.75
Water and organic matter,	24.60	24.20	49.50
Insoluble matter,	2.50	.80	2.60
	100.50	99.76	99.40
Elements of ammonia, per cent.,	.17	1.04	5.26

(1) is Rhodes' super-phosphate, and was sent by the agents in Philadelphia, Messrs. Yarnell and Trimble, for trial upon the College Farm.

(2) is Phillips' super-phosphate, and was furnished by Mr. James J. Conover, of Freehold.

(3) is the Cumberland Bone Company's super-phosphate, sent to me from the factory, in Saco, Maine, by S. R. Goodale, Secretary of the Maine Board of Agriculture.

I have no doubt these are fair average specimens of the kinds represented. They are well made and in good condition. Without any knowledge of the way they are made, I presume that (1) is from a phosphatic guano, (2) from burnt or partially burnt bones, and (3) from raw bones. The prices of (1) and (2) I think are under $60 a ton delivered, and (3) is $70 a ton at the factory. They are all well reported of by those who have used them, and they have been in market for several years. The percentage of soluble phosphoric acid is very uniform, and is probably that which manufacturers have found by experience, they can uniformly and certainly get, and the value of the manure depends mainly upon it. The ammonia is a valuable constituent to mix in the super-phosphates, and there are many manufacturers who are carefully experimenting both in their works and in the field to get an ammoniated super-phosphate which shall be quick in its action and lasting in its effects.

Of fertilizers containing phosphoric acid, the green-sand marls are the cheapest and by far the most extensively used of any in New Jersey. They contain other useful substances besides this, but they are rated in the estimation of farmers almost exactly in proportion o the amount of phosphoric acid which they contain.

The following are analyses of several different kinds:

	(1.)	(2.)	(3.)	(4.)	(5.)	(6.)
Phosphoric acid,	1.14	3.58	2.58	2.39	2.24	2.69
Sulphuric acid,	0.14	0.97	1.89	.13	.39	.26
Silicic acid,	38.70	53.15	59.80	49.34	50.80	49.40
Carbonic acid,	6.13					
Potash,	3.65	3.75	4.25	6.92	5.18	6.31
Lime,	9.07	3.27	2.97	1.22	2.13	2.52
Magnesia,	1.50	1.75	2.00	4.21	3.54	3.24
Alumina,	10.20	8.79	6.00	8.50	8.77	8.90
Oxide of iron,	18.63	15.94	11.98	16.84	17.63	17.11
Water,	10.00	8.98	8.32	9.60	9.66	9.10
	99.16	100.18	99.79	99.15	100.34	99.53

(1.) is an average of the variety of marl most largely used in eastern Monmouth. It is from the lower marl bed, not particularly rich in phosphoric acid, but remarkable for containing from 10 to 20 per cent. of carbonate of lime in fine powder, In the neighborhood of the marls, where it costs little more than the cartage, a great deal is used which is much poorer than this; but there is no trouble in finding millions of tons of this quality. It is used in larger quantities than the other varieties and is remarkable for the permanent improvement it makes in the soil.

(2.) is an average of five analyses, of the *Squankum* marl, and may be taken as a fair sample of that noted fertilizer. The specimens for analysis were taken from five different pits, and each was judged to be an average of the whole digging. There is nothing to hinder marl of the quality represented by this analysis being supplied in any quantity that may be demanded. This marl is from the green layer of the upper marl bed.

(3.) is an average of the marl dug by the Squankum Marl Company. It is supplied of this quality alone the entire line of the Raritan and Delaware Bay Railroad, and also at Port Monmouth for shipping. This marl is dug from the green and ash layers of the upper marl bed. The ash marl is poorer and more clayey than the green marl. But the mixture of the two is a good fertilizer, as both experience and the analysis show.

(4.) is the analysis of marl from the Pemberton Marl Co.'s digging. This marl has a very extensive sale along the Burlington County Railroad, and also along the various lines of the Camden and Amboy Railroad. It is a fair sample of the Burlington county marls of the middle marl bed, and such as can always be got there.

(5.) is the analysis of the marl dug at White Horse on the line of the Camden and Atlantic Railroad. There is an abundant supply of this marl to be had; and it is the source from which it can be easiest sent to all of Atlantic county and the country along the Camden and Atlantic Railroad. It is extensively used and is liked.

(6.) is the analysis of a carefully averaged sample of the marl from the West Jersey Marl Company's pits at Barnsboro'. Several hundred tons of it are sent over the West Jersey Railroad every day, to supply the wants of farmers in all the country which is reached by that road and its branches. The growing demand for this marl is the best proof of its good quality. It is from the green layer of the middle marl bed.

The fertilizing value of these marls has been found out by an experience of from 20 to 60 years. They were used to a small extent in Monmouth county about the close of the last century, and have been coming into use over a wider and wider scope of county every year since. The light pine lands, or soils worn out by the skinning cultivation of old fashioned farmers, were immediately made to produce good crops of buckwheat, potatoes, or clover, by a dressing of from one to twenty tons to the acre, and following the marled clover good crops of corn and wheat were sure to be obtained. Farmers living 20 or 25 miles away from the marl pits have found it more profitable to haul marl that distance with teams than to purchase any other manure. It furnishes the basis for improved farming, it does good both to the farmers and to their land. Enterprise, thrift and good farming have everywhere attended its use. With the opening of railroads it has become possible to tsansport marl to much greater distances than formerly, and it is now being very successfully used as far south as Cape May. Its use on our red-shale and sandstone lands has not been very extensive, but as far as tried it proves to be as useful as on the lighter soils of the southern counties. On the farm of the State Agricultural College at New Brunswick, we have been making practical trial of the marl. The West Jersey Marl Company supplied us with 50 tons of marl early in 1866, and have since sent 80 tons more. The Pemberton Marl Company sent us 20 tons at a later period of the same year, and the Squankum Marl Company sent us 100 tons in the summer of 1867. Our experience so far is that no considerable benefit is experienced during the first summer from marl put on in the spring; and if we had made a report from the first year's trials, it would have been that it was of no value. But now after the second year, we can make the following report on the use of the marl of the West Jersey Marl Company, which was the only one put on early in 1866.

Speaking of the wonderful action of marl upon the soil in a letter to the President of the Company, dated July 16, 1867, the report says:

"The marl was used in the spring of that year as a top dressing upon rather poor upland meadow ground, which had been in sod for some years, and upon potatoes in the hill. On account of the dry weather in the fore part of the summer our potato crop was almost ruined. There was not more than a quarter crop; the marled potatoes yielded perhaps one-half more than those not marled. There was no perceptible effect upon the amount of hay cut last year from the marled and unmarled portions; the crop was very light on both. The after-growth was not fed off, and it was observed towards the end of the season that the grass was much the thickest on the marled portion.

"This spring a most marked difference was seen in the growth of the grass on the two parts. That where the marl was spread was thicker, of a darker green and of a more luxuriant growth, and the proportion of clover was greatly increased. Long before the time for mowing, the marled grass had become too heavy to stand and was lodged. Last week the crop was mowed and the hay carefully put up in large and uniformed sized cocks of at least 100 pounds each. On the marled plot there were 85 cocks per acre, and on the unmarled 32, or more than twice and a half as much on the marled as on the unmarled part.

"The amount of marl used was only 80 bushels to the acre, and the value of the increased crop for this year is twice the cost of the marl used, besides leaving the ground in good condition for future crops. I will add that another plot was manured in the autumn of 1866 with flour of raw-bone, sown broad cast, at the rate of 400 lbs. to the acre. The yield of hay was almost 56 cocks to the acre, being an increase of three-quarters on that from the unmanured part, which is probably enough to pay for the cost of the fertilizer and leave all its future effects for profit."

Since the report we have gathered our potatoes and buckwheat, but they are both very poor crops where marl, and also where guano and other manures were applied. The clover sod which was marled in the spring of 1866, and then plowed up and planted in corn in 1867 yielded 104 bushels of ears to the acre, while the same sod not marled yielded 80 bushels of ears to the acre, a gain of 24 bushels, which is about enough to pay for the marl put on.

It is a lasting fertlizer; farmers of experience say that its effects can be seen from 10 to 30 years after its application.

The cause of its fertilizing action is chiefly due to its phosphoric acid. This substance is in it, combined with lime, or iron, or perhaps both. It is in a very fine powder, much finer than bone dust can be made. It is not so soluable as super-phosphate of lime, but it does dissolve, for we find it in the blue-iron earth in almost every peat bog in the marl region. These bogs receive the drainage from the marl beds, and in some way catch and hold this phosphoric acid, which comes out with the water from the marl. The phosphoric acid is probably not worth quite so much as that in the super-phosphate: if it were, the best marls would be worth about $20 a ton for that substance alone. But they are certainly worth half that. And then they must have some value for potash, of which they contain about 100 pounds to the ton. Perhaps the potash is what makes it specially beneficial to the potato. Many marls also contain from one to three per cent. of plaster; enough to give a fair dressing of that substance when five tons or 100 bushels of marl are put on an acre. The silicate of iron, which is the largest constituent of the green marl grains, is soft and easily acted on by the mildest chemical agents, and I have no doubt it plays a useful part in the enriching effect of this manure.

The following, on statistics and prices of marl, is from the State Geological Report for 1867 :

Statistics of Marl.—The amount of marl which has been carried on railroads, and mostly used outside of the marl region in 1867, is as follows :

	Bushels.	Tons.
By the Squankum Marl Company,	400,000	20,000
" Freehold and Jamesburg Ag. R. R.,	366,805	18,340
" Pemberton Marl Company,	500,000	25,000
" Camden and Atlantic Railroad,	220,000	11,000
" West Jersey Marl Company,	1,048,000	52,400

Prices of Marl.—The Squankum Marl Company deliver marl on the line of the Delaware and Raritan Bay Railroad between Eatontown and Manchester for 7½ cents a bushel, or $1.50 a ton, and at all other points on that road, as well as on board boats at Port Monmouth, for 8 cents a bushel, or $1.60 a ton. William E. Barrett, Farmingdale, Agent.

The price of Squankum marl on board of cars at Freehold is 12 cents a bushel, or $2.40 a ton, and the Freehold and Jamesburg Agricultural Railroad Company deliver it at Bordentown, Trenton and Millstone at 5 cents a bushel advance, at New Brunswick 4½ cents, Rocky Hill and South Amboy at 4¼ cents, and at all intermediate points along the railroads for lower prices, corresponding with the shorter distances. I. S. Buckalew, Jamesburg, Agent.

The Pemberton Marl Company supplies marl from the Middle Marl Bed, digging it near Birmingham, Burlington county. Their advertised prices delivered by railroad are: At Birmingham 80 cents a ton, of twenty bushels; at Mount Holly 95 cents; at Burlington $1.25; at Camden $1.70; Bordentown $1.90; South Amboy $3 00; Trenton $2.10; New Brunswick $2.90; Flemington $2.95; and at Belvidere $3 95 a ton. John S. Cook, Mount Holly, General Agent.

The White Horse marl is delivered along the line of the Camden and Atlantic Railroad for prices varying from about four cents a bushel upwards, according to distance. This marl is dug near White Horse Post Office, Camden county.

The West Jersey Marl Company deliver marl by railroad at South Amboy for $3.50 a ton of 20 bushels; New Brunswick $3.40; Trenton $2.65; Bordentown $2.45; Camden $1.70; Marlboro 90 cents;

Bridgeton $1.85; Salem $2.00, and for corresponding prices at intermediate points, and on the road to Cape May. On the Delaware and Raritan Canal the freights are less than by railroad, and the prices are lower by from 30 to 50 cents a ton. I. C. Voorhees, of Woodbury, Agent.

A great deal of worthless stuff called marl has been sold by unprincipled or ignorant men. It will be one good effect of the trade in marl coming into the hands of companies which have reputations to sustain, and depend for their profits on the sales of many years, that they will find their interest in supplying a good article only.

The best marls are found in those parts of the marl beds which are below the water level, or below the natural drainage of the country. The black or chocolate colored earth overlying some of the marls is full of copperas. This should be carefully removed, for it is destructive to vegetation, and a little of it has frequently injured the reputation of marl which was otherwise good. Pains should everywhere be taken to mix thoroughly the marl from the top, middle, and bottom of the bed, so as to get the same quality always. The fertilizing matters are not distributed uniformly through all parts of the bed; and unless care is taken in this respect very different qualities of marl may be sent from the same diggings. For these precautions the interest and the integrity of the dealers are pledged.

There is one question connected with this fertilizer that needs further experiment and study. That is the making of marl composts so as to give the marl a quicker and more efficient action on our corn, wheat and turnip crops. Composts of barnyard manure and marl for raising of wheat have been made to some extent, and farmers of much skill and experience pronounce in their favor, but the general results have not yet been attended with that careful measurement and comparison which is needed. There is no reason why the phosphates in marl should not be made as quick in their action as those in the superphosphates are. The latter were made by the application of chemical and practical science, and the marls are susceptible of the same improvement. They are more complex in their nature, however, and their successful alteration is more likely to be made by observing farmers than by any others. When the marl is properly changed it will come nearer to a perfect manure than any other, except that from the barnyard.

Lime is used largely on land wherever an improved agriculture prevails. It shows its best effects immediately upon clover and wheat. On corn it is sometimes injurious, especially if the ground is raw or lacking in vegetable or other organic matter. The lime, however, is so convenient to apply, so low in price, and upon the whole so satisfactory in its effects, that it must continue to be one of the most important of the purchased manures. There are two kinds in common use—one is that from oyster shells and limestones, which are pure carbonates of lime, and the other from magnesian limestones. The difference in composition of the two will be seen from the following analyses. Those in the first table are (1) oyster shells; (2) white limestone from Mr. Raub's, near Oxford, Warren county; (3) fossiliferous limestone from Mr. Mains, near Stillwater, Sussex county. That in the second table is from near Belvidere, Warren county, but is like almost all that has been burnt heretofore in Sussex, Warren, Hunterdon and Somerset counties, and in the adjoining counties in Pennsylvania.

	(1.)	(2.)	(3.)
Lime,	44.4	54.0	54.7
Magnesia,	1.3	.5	
Alkalies,	.4		
Carbonic acid,	35.4	43.1	43.
Phosphoric acid,	.1		
Sulphuric acid,	.6		
Alumina and oxide of iron,		1.3	.2
Silica,		.9	1.8
Water,	14.5		
Chlorine,	.4		
Organic matter,	3.0		
	100.1	99.8	100.1

Lime,	29.6
Magnesia,	20.1
Carbonic acid,	45.5
Oxide of iron and alumina,	1.4
Silica,	2.9
	99.5

After burning, the product from the oyster shells should contain 94 per cent. of pure lime, that from the white limestone 95 per cent., and that from the fossiliferous limestone almost 96 per cent , while that from magnesian limestone should contain scarcely 55 per cent. of lime. It is not well known what effect magnesia has upon vegetation, but the general opinion is, that it is not so beneficial as lime. A series of careful experiments on the comparative values of these varieties of lime would be very useful, and I hope that some of our enterprising farmers will set themselves to the work.

It will be borne in mind, however, that the measurements of the lime must be made before slaking, for a bushel of pure lime when slaked measures about three bushels, while the magnesian only about doubles in slaking. The magnesian lime is also somewhat different in quality according as it has been burned at a greater or less heat. Most of the magnesian lime burned with coal is quite different in its properties from that burned with wood.

Gas lime is much used in some portions of the State, and is liked by most farmers, and thought to be cheaper than common lime. Some farmers, however, condemn it entirely. It is recommended in any case to leave it exposed to the air for some months before using. And it is a proper subject of inquiry whether gas lime from the pure limes is different in its effects from that which is made with magnesian lime.

The subject of fertilizers is one of such practical interest that it must command the attention of every tiller of the soil. Whatever theories are advanced or suggestions made, must first be submitted to the test of experience before they can be adopted by the great body of farmers, and at some future meeting I hope to hear the experience of farmers upon some of the points presented in this lecture. It is not alone by presenting new matter that farming is improved, it is also by awakening the interest of farmers, exciting them to inquiries which their own good sense and careful observation can answer, and then getting together to compare their results. Do this at farmers' clubs, at county societies, and wherever opportunity presents, and you may be sure that you will receive your reward.

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